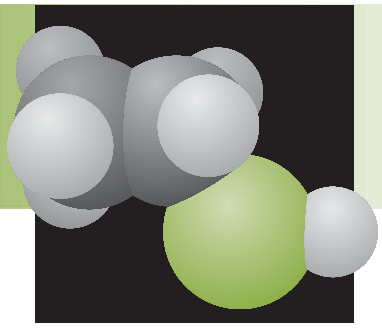
CHEMICALS
Project Fact Sheet



Production of Succinic Acid from Wood Wastes and Plants

Benefits

- Energy savings of 9.8 trillion Btu per year
- The energy savings from a single combined biological and chemical plant producing chemical components could heat 80,000 homes for a year
- 252,000 tons waste saved per year
- CO_2 is consumed during the fermentation process
- Expands markets for domestic agriculture and biomass crops.

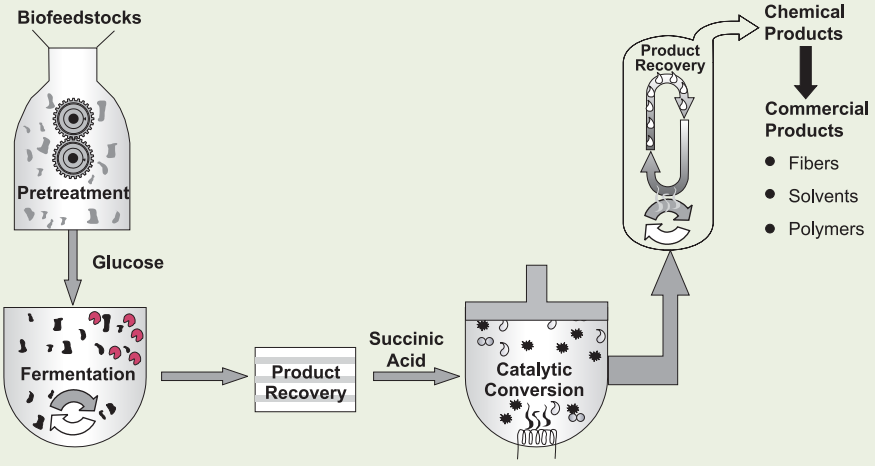
Applications

Succinic acid is a feedstock which could be used in the production of industrially important chemicals that are used in the manufacture of plastics, clothing fibers, paint, inks, food additives, automobile bumpers, and other products. Additional markets include salts, esters and succinic acid itself. The domestic market for these chemicals is more than $1.3 billion per year and is expected to expand 6 to 10 percent per year.

New bacteria will be used as a biocatalyst to produce succinic acid from biomass

A new bacteria (AFP111) is being used to ferment sugars derived from wood wastes and plant crop residues. The microorganism's metabolic pathways are being genetically engineered so they are capable of converting different types of sugars very efficiently. The new bacteria will be used to produce succinic acid, which is not currently a commodity chemical. However, if succinic acid could be produced from biomass, the lower cost would allow it to compete with more chemicals currently produced from petroleum-based feedstocks. The competively-priced succinic acid could then be used directly or as a precursor for many industrial chemicals that are used in the manufacture of plastics, paint, and other products. The result would be a significant reduction in the use of petroleum resources. In addition to the energy savings that accrue by substituting biomass for imported petroleum, carbon dioxide is "fixed" in the fermentation process, providing the potential to reduce greenhouse gas emissions during chemical production.

Biological Succinic Acid Process



Biological process produces succinic acid, which can be used to manufacture important industrial chemicals.

Project Description

Goal: Develop a novel fermentation process for succinic acid production based on conversion of lignocellulosic hydrolysates.

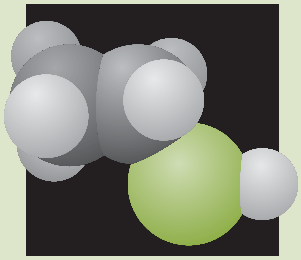
A novel E. coli strain (AFP111), which has been patented for the production of succinic acid from corn-derived glucose, will be genetically engineered to improve the conversion rates of lignocellulosic hydrolysates. AFP111 has some ability to convert mixtures of glucose and other sugars to succinic acid but not enough for industrial applications. The research focuses on metabolic engineering of the microbe and process optimization. Fermentation conditions for the efficient formation of lignocellulosic-derived succinic acid will be developed using the modified microbe and Arkenol's patented hydrolystate conversion technology.

Progress and Milestones

- A Cooperative Research and Development Agreement (CRADA) is in place between two national laboratories and Applied CarboChemicals, Inc. with Arkenol, Inc. as a collaborator.
- The purification process for fermentation-derived succinic acid was developed successfully and will be improved.
- In the first year, target pathway genes will be cloned, and fermentation of mixed sugars will be optimized.
- In the second year, AFP111 metabolism will be optimized and the fermentation process will be demonstrated using biomass-derived sugars provided by Arkenol, Inc.
- By 2001, DOE's research partners plan to operate bio-refineries capable of producing 100 million pounds/year of biologically derived chemicals.
- Pilot demonstrations, economic assessments, market development, engineering design, and process commercialization will be conducted by Applied CarboChemicals, Inc.

Awards

A 1997 R&D 100 Award was awarded for prior research that developed the new process and the bacteria that converted corn sugar to biosynthetically-derived organic acids. Using a similar approach, the current research is based on wood-derived feedstocks which are estimated to cost less per pound than corn sugar.



Project Partners

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Applied CarboChemicals, Inc.
Los Angeles, CA

Oak Ridge National Laboratory
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February 1999